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Introduction

Liquid fed flame spray pyrolysis (FSP) is a novel one-step synthesis method for nano-sized particles [1]. Organic metal precursors are dissolved in an organic solvent which is sprayed with high velocity oxygen and ignited with a small methane-oxygen flame. The collected flame product is non-porous nanoparticles [1], particularly interesting in catalysis. Here they are investigated as hydrotreating catalysts to remove sulphur and nitrogen from heterocyclic compounds in crude oil [2]. Industrial hydrotreating catalysts contain Co or Ni promoted MoS_2 as active phase, on an alumina support [2]. The transition metal sulphide phase has been obtained after sulfiding the directly by FSP prepared material [3].

Results

Seven $CoMo/Al_2O_3$ samples were synthesized by FSP. The catalysts had specific surface areas between 221 and 90 m^2/g, with decreasing surface area with increasing transition metal content. This corresponds to average primary particle sizes of 7 to 13 nm, showing that nanoparticles were the flame product [3].

The activities of the catalysts for removal of heterocyclic sulphur and nitrogen were measured after sulfidation. The best catalysts contained 16 wt.% Mo (atomic ratio Co/Mo = 1/3). With approximately 75% of the activity of a commercial alumina supported CoMo catalyst this is strikingly good [3]. X-ray diffraction (XRD) and UV-vis reflectance spectroscopy revealed that the oxide precursor contained γ-Al_2O_3 with some $CoAl_2O_4$ spinel, while MoO_3 was XRD amorphous [3]. Experiments of suppressing the undesired $CoAl_2O_4$ spinel are presently under way.

References

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